Small Business Innovation Research/Small Business Tech Transfer

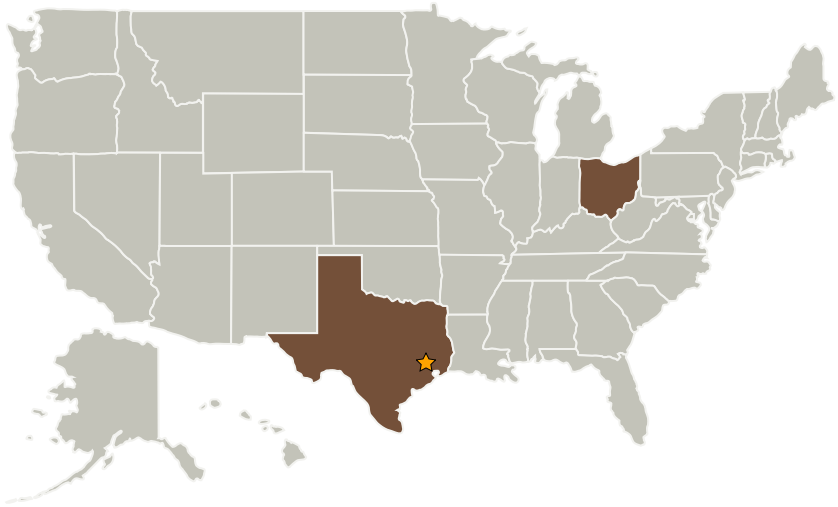
Finite Element Models for Electron Beam Freeform Fabrication Process, Phase II

Completed Technology Project (2005 - 2007)

Project Introduction

This Small Business Innovation Research Phase II proposal offers to develop a comprehensive computer simulation methodology based on the finite element method for the simulation of the electron beam freeform fabrication process. It will utilize the successful accomplishments of Phase I project. The following major tasks are proposed for Phase II; (1) a user subroutine to model Gaussian distribution of the heat input, (3) a new highly sophisticated thermal model of material deposition, (4) a user subroutine for the prediction of microstructure with graphical representation of the output, (5) study of convection in the melt pool to determine its shape, (6) fabrication of three different types of samples and measurements of microstructure, residual stresses and distortions, and (7) computer simulation of the samples using all models developed under the program for their verification. A thermo-mechanical code ABAQUS will be the primary simulation tool. A computational fluid dynamics code, FLUENT, will be used for the study of the melt pool shape. These models will be applicable to ground-based as well as space-based EB systems. They will also be applicable to laser, TIG and other deposition processes. A strategy for the commercialization of the methodology and products is discussed.

Primary U.S. Work Locations and Key Partners



Finite Element Models for Electron Beam Freeform Fabrication Process, Phase II

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

Finite Element Models for Electron Beam Freeform Fabrication Process, Phase II

Completed Technology Project (2005 - 2007)

Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Modern Computational Technologies, Inc.	Supporting Organization	Industry	Cincinnati, Ohio

Primary U.S. Work Locations	
Ohio	Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.5 Modeling and Simulation for EDL